

Managing Municipal Wastewater in Saskatchewan Characterization Studies

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The Canadian Council of Ministers of Environment (CCME) has developed a Canada-wide Strategy for the Management of Municipal Wastewater Effluent (also called MWW Strategy) for effluent discharged into surface water from wastewater treatment plants. The Strategy requires all municipal wastewater treatment plants in Canada including Saskatchewan that are discharging effluent into fish bearing waters to achieve National Performance Standards (NPS) and develop site-specific Effluent Discharge Objectives (EDOs). The strategy also helps to better manage the wastewater facilities and to set up the standard for the future new facilities.

Implementation and Study

Implementation of the strategy requires long-term planning on the part of jurisdictions in Canada. Strategy implementation will be flexible and based on risk, available funding and financial sustainability over a maximum period of 30 years (CCME, 2009). NPS developed by CCME have been adopted in Saskatchewan and communities are requested to meet these standards within the timeline. As outlined in the strategy (Figure 1), an assessment of receiving environment is to be conducted to determine whether or not the levels of substances discharged into receiving

environment are protective of aquatic organisms (CCME, 2008). For levels that are not protective, an Effluent Discharge Objective (EDO) should be established. EDOs represent the maximum concentration and load of the substance at the end-of-pipe that will enable the receiving water to meet the Environmental Quality Objectives (EQOs) at the edge of the mixing zone.

In Saskatchewan, 91 communities are affected by the MWW strategy: 62 very small, 20 small, seven medium and two very large. Saskatchewan Ministry of Environment (MOE) continues to work with these communities to assess the impacts of treated wastewater on receiving environment and implement upgraded sewage works to meet the regulations. During 2011/12, all these communities are requested to conduct an effluent characterization study to determine the impacts on receiving environment and to establish site-specific EDOs. The study included both acute and chronic toxicity testing of treated municipal wastewater samples, and analysis of parameters, such as pathogens, nutrients, PAH, and metals.

MOE spent approximately \$150,000 to conduct the effluent characterization studies for small communities in the province. Samples are collected from discharge locations and consisted of four sampling events; spring and summer 2011, fall 2011, and winter 2012. Continuous discharge facilities participated in all sampling events whereas intermittent discharge facilities participated only in spring and fall events. After completion of characterization study, the communities must conduct an Environmental Risk Assessment and establish site-specific EDOs by 2017. MOE is also conducting mixing zone sampling for

small communities by collecting samples from upstream/downstream locations of receiving environment. Samples are collected (Figure 2) approximately 100 meters from the treated effluent discharge points (Figure 3) of selected communities and analysed for various water quality parameters.

Results and Analysis

Although the results for the four sampling events are available, the assessment of the impacts of treated effluent on receiving environment and analysis may not be possible until all mixing zone sampling events are completed and risk assessment determined, however, a brief overview of available results and analysis is presented below.

The acute toxicity testing (both pH of the effluent adjusted and unadjusted) was conducted using rainbow trout multiple concentration test following method EPS 1/RM/13. Chronic toxicity testing was conducted using serial dilutions of *Ceriodaphnia dubia* test following method EPS 1/RM/21. Test failures are defined as effluent at 100% concentration that kills more than 50% of the test organisms during the specified test period. The primary focus of the acute testing is to determine LC50 and mortality values. An LC50 value is an indication of the concentration of a chemical in water which is expected to cause death in 50 percent of test animals living in that water. Mortality values are the percentage of fish killed at 100% concentration.

Overall, the majority of samples passed the acute toxicity tests (Figure 4). This includes both pH adjusted and unadjusted samples. Repeat sampling is being conducted in the fiscal 2012/13 for the communities that failed

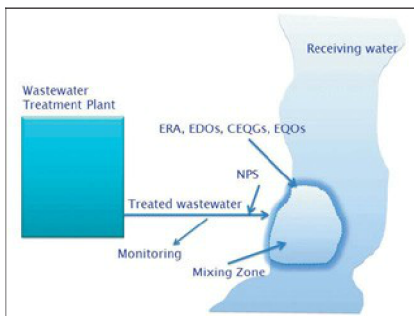


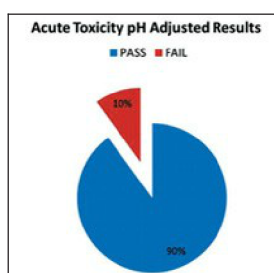
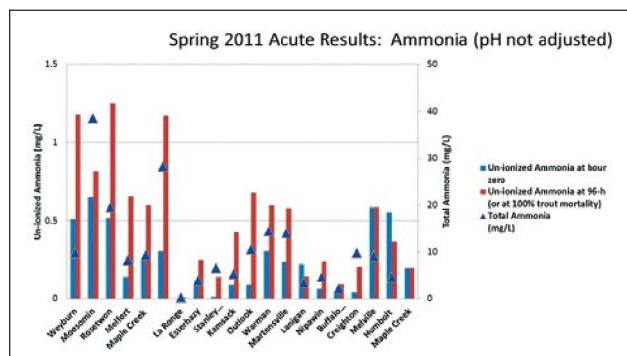
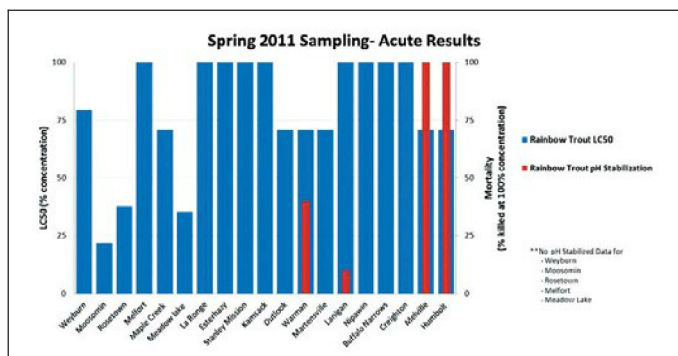
Figure 1: MWW STRATEGY




Figure 2: SAMPLE COLLECTION AT THE DOWNSTREAM END



Figure 3: DISCHARGE OF TREATED MUNICIPAL WASTEWATER INTO RECEIVING ENVIRONMENT



in toxicity testing. Figure 5 shows the LC50 and mortality values of acute toxicity tests of samples collected during spring 2011. A high number of results passing the LC50 acute toxicity test indicate a higher quality of treated effluent, whereas a high mortality rate indicates a lower quality of the treated effluent. The values

of total ammonia and unionized ammonia at the beginning and end of acute toxicity testing tests are determined and the Figure 6 shows the values for spring 2011 Sampling event. All the communities in Saskatchewan are instructed to conduct the Environmental Risk Assessment and based on the assessment the communities may have to upgrade the existing wastewater treatment units to meet the NPS, toxicity parameters and the EDOs. 

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